

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DIVERSION

(Ft.)

CODE 362

DEFINITION

A channel constructed across the slope generally with a supporting ridge on the lower side.

PURPOSE

This practice may be applied as part of a resource management system to support one or more of the following purposes.

- Break up concentrations of water on long slopes, on undulating land surfaces, and on land that is generally considered too flat or irregular for terracing
- Divert water away from farmsteads, agricultural waste systems, and other improvements
- Collect or direct water for water-spreading or water-harvesting systems
- Increase or decrease the drainage area above ponds
- Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above
- Intercept surface and shallow subsurface flow
- Reduce runoff damages from upland runoff
- Reduce erosion and runoff on urban or developing areas and at construction or mining sites
- Divert water away from active gullies or critically eroding areas
- Supplement water management on conservation cropping or stripcropping systems

CONDITIONS WHERE PRACTICE APPLIES

This applies to all cropland and other land uses where surface runoff water control and/or management is needed. It also applies where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

CRITERIA

Capacity. Diversions as temporary measures, with an expected life span of less than 2 years, shall have a minimum capacity for the peak discharge from the 2-year frequency, 24-hour duration storm.

Diversions that protect agricultural and recreational land shall have a minimum capacity for the peak discharge from a 10-year frequency, 24-hour duration storm.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems shall have a minimum capacity for the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour duration storm. Freeboard shall be not less than 0.3 ft.

Design depth is the channel storm flow depth plus freeboard, where required.

Cross section. The channel may be parabolic, V-shaped, or trapezoidal. The diversion shall be designed to have stable side slopes.

The ridge shall have a minimum top width of 4 ft. at the design depth. The ridge height shall include an adequate settlement factor.

The ridge top width may be 3 ft at the design depth for diversions with less than 10 acres drainage area above cropland, pastureland, or woodland.

The top of the constructed ridge at any point shall not be lower than the design depth plus specified overfill for settlement.

The design depth at culvert crossings shall be the culvert headwater depth for the design storm plus freeboard.

Grade and velocity. Channel grades may be uniform or variable. Channel velocity shall not exceed that considered non-erosive for the soil and planned vegetation or lining.

Maximum channel velocities for permanently vegetated channels shall not exceed those recommended in the NRCS Engineering Field Handbook (EFH) Part 650, Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels (Sept. 1987).

When the capacity is determined by the formula $Q = A V$ and the V is calculated by using Manning's equation, the highest expected value of "n" shall be used.

If the diversion channel will have a cover crop, D or E retardance values can be used for the permissible velocity for stability. E retardance will only be used when a lawn or turf vegetation is planned. If a cover crop is not used in the establishment of the diversion, or the diversion channel is farmed through, Manning's formula with an "n" value of 0.025 will then be used for stability analysis.

B or C retardance values will be used for capacity. The designer will select proper retardance values based on cover and expected condition. Table 3 and Table 4 in Practice Standard 412, Grassed Waterway, can be used as a guide to select proper channel retardance values.

The maximum permissible velocities will be determined by site soil conditions. Determination of soil types in diversion and expected vegetative cover is necessary to determine maximum permissible velocities. The following table may be used to determine permissible velocities.

*Permissible Velocities****

Soils Description			Permissible Velocity Ft./Sec.		
Unified Symbol	Plasticity	Soil Texture	Bare Channel	Retardance	
				D	E
SP, SW SM, ML	Non Plastic to Low Plasticity (PI less than 10)	Sand Loamy sand	2.0	2.5	2.25
CL, SC	Moderate Plasticity (PI from 10-20)	Loam Silty loam Clay loam Silty clay loam	2.5	3.0	2.75
MH CH	High Plasticity (PI greater than 20)	Silty clay Clay	3.0	4.0	3.5

***Permissible velocities shall be decreased by 25% for diversion channel grades steeper than 5%.

Location. The outlet conditions, topography, land use, cultural operations, cultural resources, and soil type shall determine the location of the diversion.

Protection against sedimentation. Diversions normally should not be used below high sediment producing areas. When they are, a practice or

combination of practices needed to prevent damaging accumulations of sediment in the channel shall be installed. This may include practices such as land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. Install practices in conjunction with or before the diversion construction.

If movement of sediment into the channel is a problem, the design shall include extra capacity for sediment or periodic removal as outlined in the operation and maintenance plan.

Outlets. Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, a vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Vegetative outlets shall be installed and established before diversion construction to insure establishment of vegetative cover in the outlet channel.

The release rate of an under ground outlet, when combined with storage, shall be such that the design storm runoff will not overtop the diversion ridge.

The design depth of the water surface in the diversion shall not be lower than the design elevation of the water surface in the outlet at their junction when both are operating at design flow.

Vegetation. Disturbed areas that are not to be cultivated shall be seeded as soon as practicable after construction.

Lining. If the soils or climatic conditions preclude the use of vegetation for erosion protection, non-vegetative linings such as gravel, rock riprap, cellular block, or other approved manufactured lining systems may be used.

CONSIDERATIONS

A diversion in a cultivated field should be aligned and spaced from other structures or practices to permit use of modern farming equipment. The side slope lengths should be sized to fit equipment widths when cropped.

At non-cropland sites, consider planting native vegetation in areas disturbed due to construction.

Maximize wetland functions and values with the diversion design. Minimize adverse effects to existing functions and values. Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology. Any construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat,

including habitat for threatened, endangered, and other species of concern.

On landforms where archeological sites are likely to occur, use techniques to maximize identification of such sites prior to planning, design, and construction.

PLANS AND SPECIFICATIONS

Plans and specification for installing diversions shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for use by the client. The plan shall include specific instructions for maintaining diversion capacity, storage, ridge height, and outlets.

The minimum requirements to be addressed in the operation and maintenance plan are:

1. Provide periodic inspections, especially immediately following significant storms.
2. Promptly repair or replace damaged components of the diversion as necessary.
3. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment yielding areas are in the drainage area above the diversion. Establish necessary clean-out requirements.
4. Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Inlets damaged by farm machinery must be replaced or repaired immediately.
5. Redistribute sediment as necessary to maintain the capacity of the diversion.
6. Vegetation shall be maintained and trees and brush controlled by hand, chemical and/or mechanical means.
7. Keep machinery away from steep sloped ridges. Keep equipment operators informed of all potential hazards.